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UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)
(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No. 1334

Total Pages in this Submission

TO THE ASSISTANT COMMISSIONER FOR PATENTS
Box Patent Application
Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for invention entitled:

METHOD FOR MOTION-COMPENSATED PREDICTION OF MOVING IMAGES AND DEVICE FOR PERFORMING SAID METHOD

and invented by:

Hans-Georg MUSMANN, Thomas WEDI

If a CONTINUATION APPLICATION, *check appropriate box and supply the requisite information:*

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Which is a:

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Which is a:

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Enclosed are:

Application Elements

1. ☒ Filing fee as calculated and transmitted as described below

2. ☒ Specification having _____18_____ pages and including the following:

   a. ☒ Descriptive Title of the Invention

   b. ☐ Cross References to Related Applications *(if applicable)*

   c. ☐ Statement Regarding Federally-sponsored Research/Development *(if applicable)*

   d. ☐ Reference to Microfiche Appendix *(if applicable)*

   e. ☒ Background of the Invention

   f. ☒ Brief Summary of the Invention

   g. ☒ Brief Description of the Drawings *(if drawings filed)*

   h. ☒ Detailed Description

   i. ☒ Claim(s) as Classified Below

   j. ☒ Abstract of the Disclosure

P01ULRG/REV04

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1334</td></tr>
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Application Elements (Continued)

3. ☒ Drawing(s) *(when necessary as prescribed by 35 USC 113)*

    a. ☒   Formal   Number of Sheets   4

    b. ☐   Informal   Number of Sheets

4. ☒ Oath or Declaration

    a. ☐   Newly executed *(original or copy)*   ☒   Unexecuted

    b. ☐   Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*

    c. ☒   With Power of Attorney   ☐   Without Power of Attorney

    d. ☐   *DELETION OF INVENTOR(S)*
         Signed statement attached deleting inventor(s) named in the prior application,
         see 37 C.F.R. 1.63(d)(2) and 1.33(b).

5. ☐ Incorporation By Reference *(usable if Box 4b is checked)*
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. ☐ Computer Program in Microfiche *(Appendix)*

7. ☐ Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all must be included)*

    a. ☐   Paper Copy

    b. ☐   Computer Readable Copy *(identical to computer copy)*

    c. ☐   Statement Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

8. ☐ Assignment Papers *(cover sheet & document(s))*

9. ☐ 37 CFR 3.73(B) Statement *(when there is an assignee)*

10. ☐ English Translation Document *(if applicable)*

11. ☐ Information Disclosure Statement/PTO-1449   ☐   Copies of IDS Citations

12. ☐ Preliminary Amendment

13. ☒ Acknowledgment postcard

14. ☒ Certificate of Mailing

    ☐   First Class   ☒   Express Mail *(Specify Label No.):*   <u>EF 042303152 US</u>

UTILITY PATENT APPLICATION TRANSMITTAL
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(Only for new nonprovisional applications under 37 CFR 1.53(b))

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Accompanying Application Parts (Continued)

15. ☒ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*

16. ☐ Additional Enclosures *(please identify below):*

Fee Calculation and Transmittal

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra	Rate	Fee
Total Claims	8	- 20 =	0	x $18.00	$0.00
Indep. Claims	2	- 3 =	0	x $80.00	$0.00
Multiple Dependent Claims (check if applicable) ☒					$270.00
				BASIC FEE	$710.00
OTHER FEE *(specify purpose)*					
				TOTAL FILING FEE	$980.00

☐ A check in the amount of   to cover the filing fee is enclosed.

☒ The Commissioner is hereby authorized to charge and credit Deposit Account No.   19-4675
as described below. A duplicate copy of this sheet is enclosed.

    ☒ Charge the amount of   **$980.00**   as filing fee.

    ☒ Credit any overpayment.

    ☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.

    ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance,
pursuant to 37 C.F.R. 1.311(b).

_____
Signature

Dated: **OCTOBER 23, 2000**

CC:

P01ULRG/REV04

BE IT KNOWN that WE, Hans-Georg MUSMANN and Thomas WEDI,

citizens of Germany, whose post office addresses and residencies are,

respectively, Heckenrosenweg 24, 38259 Salzgitter 51, Germany; and In der

Steinriede 12, 30161 Hannover, Germany; have invented certain new and useful

5   improvements in a

METHOD FOR MOTION-COMPENSATED PREDICTION OF MOVING

IMAGES AND DEVICE FOR PERFORMING SAID METHOD

10   of which the following is a complete specification thereof:

1

Background of the Invention

1. Field of the Invention

The present invention relates to a method for motion-compensated

prediction of moving images or pictures using an interpolation method. It also

5   relates to a device for performing the said method.

2. Prior Art

Standard methods for coding of moving images or pictures (H. 263,

MPEG-2, MPEG-4, etc) are based on the principle of the so-called hybridized

10   coding, as described in ISO/IEC 14496-2, "Final Draft International Standard of

MPEG-4", Atlantic City, October 1998, MPEG98/N2502. Fig. 1 is a block

diagram of a hybrid video-encoder with motion-compensated prediction. The

actual picture signal s(t) to be coded with the help of the motion-compensated

prediction (motion compensation MC) is predicted from the previously

15   transmitted reference picture s'(t-1). The motion-compensated prediction is

performed with the help of a so-called block-wise motion vector d(t), which is

determined with the help of a motion estimation (motion estimation ME). It gives

the position of the block used for prediction in the already transmitted reference

picture s'(t-1) for each block of size 8 x 8 and/or 16 x 16 image points of the

20   actual picture. The result of the motion-compensated prediction is the prediction

signal $\hat{s}$ (t). The residual prediction error e (t) = s (t) - $\hat{s}$ (t) and the motion vector

d(t) are coded at the output of the intraframe encoder IE and transmitted. To

obtain the reference picture s'(t-1) the intraframe-encoded prediction error e(t) is

again decoded (intraframe decoder ID) and added to the prediction signal ŝ (t).

With the help of a picture memory z^{-1} the reference picture s'(t-1) is prepared.

This reference picture s'(t-1) acts both as an input signal for motion

compensation MC and also for motion estimation ME. The motion estimation ME

5   supplies a motion vector for the respective block of image points with which the

motion compensation MC is controlled, i.e. image points of a block are moved

with the aid of the motion vector, with the aid of the actual picture s(t) and the

reference picture s'(t-1).

In the current standardized coding method the amplitude resolution of the

10   motion vector amounts to half an image point. For estimation and compensation

thus image points must be interpolated in the picture s'(t-1) between the

scanning raster, which corresponds to an increase of the scanning rate of about

a factor L = 2. For example, in the MPEG-4 verification model, as described in

the ISO/IEC 14496-2 reference, these image points are produced by bilinear

15   interpolation filtering of the image points in the scanning raster (see Fig. 2). In

the following description the picture interpolated from s'(t-1) is designated with

s'u(t-1). The interpolated values "+" are produced by interpolation between the

scanned values "O" with the interpolation prescription:

A = (A+B)//2, b= (A+B+C+D)//4, c= (A+C)//2. The symbol "//" represents a

20   rounded off whole number division. The interpolation and thus the motion-

compensated prediction is disturbed by different aliasing in the picture signal s(t)

and the prediction signal ŝ (t) as described in ISO/IEC/SC29/WG11: "Core

Experiment on Motion and Aliasing-compensation Prediction (P8)", Stockholm,

July 1997, MPEG97/N1180; in U. Benzler, O. Werner, "Improving Multiresolution Motion Compensating Hybrid Coding by Drift Reduction", Picture Coding Symposium 1996, March 1996, Melbourne; and in WO 99/04574, so that a greater precision for the motion vector using the simple bilinear interpolation

5   permits no additional improvements of coding efficiency. An improved method for making the prediction signal was suggested in ISO/IEC/SC29/WG11: "Core Experiment on Motion and Aliasing-compensation Prediction (P8)", Stockholm, July 1997, MPEG97/N1180 and WO 99/04574 for these reasons. The aliasing signal is reduced in the prediction signal by an N-stage aliasing-reducing "Finite

10 Impulse Response".

Summary of the Invention

It is an object of the present invention to provide an improved method for

15 motion-prediction of moving images, which does not have the above-described disadvantages.

It is another object of the present invention to provide an apparatus or device for performing this method.

The process for motion-compensated prediction of moving images or

20 pictures using an interpolation method comprises the following steps:

a) considering past image points as well as neighboring image points in the interpolation method;

4

b) making a motion-compensated picture signal ($\hat{s}_{tri}$ (t-1)) using past

image point information (s_{tri} (t-2)), wherein the image point information is input

according to a previously determined motion vector; and

c) inserting the image point information of the motion-compensated

5   picture signal ($\hat{s}_{tri}$ (t-1)) in an interpolation raster between the image points of a

reference picture.

According to the invention the device for performing this method

comprises means for increasing the scanning rate of the reference picture,

means for a recursive motion compensation of the reference picture with an

10   image memory for past image point information; a merging module for including

motion compensated image point information in an interpolation raster between

the image points of the reference picture.

With the features of the device and method according to the invention the

prediction signals $\hat{s}$ (t) related to the picture signal s(t) are correctly produced

15   including aliasing. Past image points as well as neighboring local image points

are used for the interpolation. A reduction of the prediction error and thus an

increase in the coding efficiency results when the method according to the

invention is used.

An increased amplitude resolution of the motion vector of up to 1/4 or 1/8

20   of an image point can be successfully employed with the features of the

invention and leads to an additional improvement of the coding efficiency. The

scanning rate of the already transmitted reference picture must thus be

increased about a factor of L=4 and L=8 in the horizontal and vertical directions respectively.

The invention is based on the following understanding and knowledge:

Aliasing occurs digitally in the coded picture signal because of a non-ideal low pass in the reception process. The aliasing has the consequence that the picture signal cannot be perfectly reconstructed by a purely local interpolation in the image points between the scanning raster and the motion-compensated prediction cannot predict the picture signal correctly. A prediction error remains, which must be transmitted in coded form. The size of the prediction error determines the transmission rate and the coding efficiency.

New formulations reduce aliasing in the prediction signal with the help of an FIR filter and improve the coding efficiency as described in WO 99/04574. However since the picture signal to be coded contains the aliasing, the aliasing in the prediction signal will not be reduced, but conforms with that of the picture signal s(t), in order to reduce the size of the additional prediction error.

The invention is based on the following assumptions: If a non-moving analog picture is scanned at the same position at different times, the corresponding scanned values are identical. This is also true for the case in which the scanning frequency is not sufficiently large enough and the scanned picture signal contains aliasing. If the contents of the analog picture signal move about exactly one image point, the corresponding scanned values are similarly identical and thus have the same aliasing signal. This shows that the aliasing does not effect a prediction of the image contents displaced about an integral

number of image points. Accordingly the method according to the invention for interpolation of intervening values uses past, i.e. temporally previous scanned, values, in order to reconstruct the actual intervening values. For example, if it is known that the image content moves from picture to picture about 1/4 of an

5   image point spacing, one scanning value can be used to reconstruct the image content displaced about 1/4 of an image point spacing in the next picture. Since this scanned value is already on the scanning raster at an earlier time point, it contains the correct image signal with the correct aliasing.

Scanned values from the previous or past pictures are used according to

10   the invention in order to reconstruct the actual intervening values abased on these prerequisites or assumptions. The filter can thus correctly predict the picture signal including the aliasing. It reduces the prediction error and incrases the coding efficiency.

Brief Description of the Drawing

15

The objects, features and advantages of the invention will now be   ·
illustrated in more detail with the aid of the following description of the preferred embodiments, with reference to the accompanying figures in which:

20   Figure 1 is a block diagram for a device for motion-compensated prediction of moving images or pictures according to the prior art;

Figure 2 is a diagram illustrating interpolation of image points in a picture;

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Figure 3 is a block diagram for an interpolation filter for the device for motion-compensated prediction of moving images or pictures according to the invention;

Figure 4 is a diagram illustrating the increase of the scanning rate due to the method according to the invention for L=2;

Figure 5 is a diagram illustrating the operation of the merging module used in the device for performing the method according to the invention;

Figure 6 is a graphical illustration of the experimentally determined rate for synthetic test sequence Syn waves; and

Figure 7 is a graphical illustration of the experimentally determined rate for the test sequence "mobile & calendar".

Description of the Preferred Embodiments

The block diagram of an interpolation filter shown in Fig. 3 is used in the device for performing the method according to the invention. It is built into the prior art device shown in Fig. 1. The symbols used in Fig. 1, for example s'(t-1) for the reference picture, are also used in the follow description of Figs. 3 to 7.

In a stage or means 1 the scanning rate of the already transmitted reference picture s'(t-1) is increased by the factor L. The result of the filtering indicated in Fig. 3 is the interpolated image su'(t-1). Since a temporally recursive

filter is used for filtering according to Fig. 3, in the following it is designated as a TRI filter (time-recursive interpolation filter).

The TRI filter comprises three stages. The first stage is the so-called expander 1. The second stage or means includes the recursive structure with the motion compensation 4 and the merging module 3. The third stage or means 5 performs a conventional local interpolation (spatial interpolation). These three stages are described in more detail in the following description.

In a first part, the expander, the scanning rate of the input image - reference image - s'(t-1) is increased about a factor L. This occurs because the intervening values of the scanning raster from the reference picture s'(t-1) are filled with marker values m (Fig. 4). The marker values m characterize intervening values which are up to now still not interpolated.

The following equation (1) describes the expander. In this equation x and y represent the local image coordinates.

$$S_e(t-1,x,y) = \{s'(t-1, x/L, y/L), \quad \text{if } x, y = 0, \pm L, \pm 2L,.., \tag{1}$$

$$= \ m \ \text{otherwise}\}.$$

In the second stage or means the past picture $s_{tri}(t-2)$ is also used in order to replace marked values in the picture with increased scanning rate $s_e(t-1)$. This occurs with the help of motion compensation 4 by image points of the past picture $s_{tri}(t-2)$, in which the image points are displaced according to their already transmitted motion vector L*d(t-1). Thus it should be noted that the

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motion vector is multiplied with a factor L, when a picture with a resolution

increased by L is used for compensation. In the merging module 3 the values

marked in the picture $s_e(t-1)$ are replaced by the corresponding values from the

picture signal $\hat{s}_{tri}$ (t-1), which appear at the output of the motion compensation

5   means 4. The following equation (2) describes the merging process, whose

result is the picture $s_{tri}(t-1)$. In this equation (2) also x and y represent the local

picture or image coordinates.

$$s_{tri}(t-1,x.y) \;=\; \{\; \hat{s}_{tri}\,(t-1,x,y), \;\; \text{if } s_e(t-1,x,y) = m; \tag{2}$$

10    $$\text{otherwise } s_e(t-1,x,y)\;\}.$$

Fig. 5 illustrates the operation of the merging module 3. The equation and

Fig. 5 show that both pictures $s_e(t-1)$ and $\hat{s}_{tri}$ (t-1) are blended or merged to form

the picture $s_{tri}(t-1)$. At the position where a marker value m is found in the

15   picture $s_e(t-1)$, the corresponding image point from the predicated picture

$\hat{s}_{tri}$ (t-1) is used. All remaining values from the picture $s_e(t-1)$ are taken into the

picture $\hat{s}_{tri}$ (t-1). Thus the scanning values from the motion-compensated picture

$\hat{s}_{tri}$ (t-1) are used, in order to interpolate the image points (marker values) in the

picture $s_e(t-1)$.

20   The third stage or means produces a purely local spatial interpolation 5

according to WO 99/04574 A1, in which the remaining marked values of the

picture s_{tri}(t-1) exclusively are interpolated. The result is the interpolated picture s'u(t-1).

The picture s_{tri}(t-1) is intialized with the picture s_e(t-1) at the time point t = 1, at which no picture s_{tri}(t-2) exists. The marked values in the picture s_{tri}(t-1) are reconstructed by a local interpolation. This corresponds to a conventional purely local interpolation.

Based on the recursive structure, in which image points from the past picture s_{tri}(t-2) are used, in order to produce the picture s_{tri}(t-1), an unlimited dwell time of individual image points in the picture memory 6 (s_{tri}) required for the motion compensation is possible. In order to prevent image point information from remaining for too long a time in the picture memory 6, a counting index is provided for each image point in the memory, which gives the dwell time of the individual image point information. With the help of this index and a threshold value set at the start of the method image point information, which exceeds a predetermined dwell time in memory, is removed from the picture memory 6. The typical dwell time amounts from three to six of the successive pictures.

The TRI filter, as described in ISO/IEC 14496-2, "Final Draft International Standard of MPEG-4", Atlantic City, October 1998, MPEG98/N2502, was integrated in the existing software of the verification model for the experimental results. Two different modes with different resolutions are supported. In the first case motion vectors with a resolution of a half an image point and a bilinear interpolation are used. In this case the reference method (original code) is

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designated with MPEG4-hp and the method with the new TRI filter is designated

with TRI-hp (hp - half pel). In the second case motion vectors with a resolution of

a fourth image point and an aliasing-reducing Wiener filter are used. In this case

the reference method is designated with MPEG4-qp and the new method is

5   designated with TRI-qp (qp = quarter pel). For the purely local spatial

interpolation in the TRI filter the corresponding local interpolation method uses

the reference code.

For producing the test results a synthetic and a real test sequence was

used in Figs. 6 and 7. The synthetic sequence was produced by scanning two

10   analogous sine signals, in which the frequency of the first sine signal is below

and that of the second sine signal is above half the scanning frequency.

Accordingly the second sine signal produces aliasing in the scanned picture

signal. Further the analogous picture signal is displaced about exactly a half an

image point between successive pictures. This displacement can be estimated

15   by the code used without error, so that a remaining prediction error can be fed

back into an extended interpolation. This synthetic sequence is designated with

Syn waves. With the real test sequence it is a matter of the test sequence

"mobile & calender".

The results for the synthetic sequence Syn Waves is illustrated in Fig. 6.

20   Although the picture-to-picture displacement of a half an image point can

be correctly estimated by all codes, the reference code with the conventional

interpolation filter is not in a position to correctly predict the image signal.

Accordingly a considerable data rate must be provided for the coding of the

prediction error. The MPEG4-qp coder itself, which operates with an aliasing-reducing Wiener filter, can predicted the picture signal only insufficiently. Accordingly the coder with the TRI filter according to the invention is in a position to predict the picture signal correctly including aliasing, so that a

5   considerably lower data rate is required. The single remaining prediction error is based on the quantization error, which arises in the intra-frame encoder.

In Fig. 7 the results for the real test sequence "Mobile and Calender" are presented. A significant improvement is observed due to the use of the TRI filter according to the invention. An improvement of 0.8 dM has been shown between

10   MPEG4-hp and TRI-hp and an improvement of 0.4 dB has been shown between MPEG4-qp and TRI-qp. The reason for the reduced gain relative to the test sequence Syn waves is because the motion-compensated prediction is disturbed by the displacement estimation error. Also the aliasing signal has no components as large in the total signal as in the synthetic sequence.

15   The disclosure in German Patent Application 199 51 341.4 of October 25, 1999 is incorporated here by reference. This German Patent Application describes the invention described hereinabove and claimed in the claims   : appended hereinbelow and provides the basis for a claim of priority for the instant invention under 35 U.S.C. 119.

20   While the invention has been illustrated and described as embodied in a method and apparatus for motion-compensated prediction of moving images or pictures using an interpolation method, it is not intended to be limited to the

details shown, since various modifications and changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention.

What is claimed is new and is set forth in the following appended claims.

We Claim:

1   1. A process for motion-compensated prediction of moving images or pictures

2   using an interpolation method, said process comprising the steps of:

3   a) considering past image points as well as neighboring image points in

4   the interpolation method;

5   b) making a motion-compensated picture signal ($\hat{s}_{tri}$ (t-1)) using past

6   image point information (s_{tri} (t-2)), wherein said past image point information is

7   input according to a previously determined motion vector thereof; and

8   c) inserting said past image point information of the motion-compensated

9   picture signal ($\hat{s}_{tri}$ (t-1)) in an interpolation raster between image points of a

10   reference picture (s'(t-1)).

1   2. The process as defined in claim 1, further comprising producing an

2   intermediate picture (s_e(t-1)) from said reference picture (s'(t-1)) by increasing

3   scanning rate, wherein intervening image points between said image points of

4   the reference picture (s'(t-1)) form said interpolation raster, filling said

5   intervening image points by marker values (m) and replacing said marker values

6   (m) at locations where said past image point information for the motion-

7   compensated picture signal ($\hat{s}_{tri}$ (t-1)) is present.

1   3. The process as defined in claim 2, wherein said marker values (m) that are

2   not replaced by said past image point information of the motion-compensated

3   picture signal ($\hat{S}_{tri}$ (t-1)) are replaced by locally interpolated image points.

1   4. A device for motion-compensated prediction of moving images or pictures

2   using an interpolation method, said device comprising means (1) for increasing a

3   scanning rate of a reference picture, means (4) for a recursive motion

4   compensation of the reference picture with an image memory (2) for past image

5   point information; a merging module (3) for including motion-compensated image

6   point information in an interpolation raster between image points of the reference

7   picture.

1   5. The device as defined in claim 4, further comprising an interpolation stage (5)

2   for local interpolation of intervening image points of an interpolation raster not

3   already occupied in said merging module (3).

1   6. The device as defined in claim 4 or 5, wherein said means (4) for a recursive

2   motion compensation of the reference picture includes a picture memory (6) and

3   means for preparing a count index for each newly entered one of said image

4   points in said picture memory (6), and, when one of said image points has a

5   value of said count index corresponding to a predetermined dwell time limit, said

6   one of said image points is removed from said picture memory (6).

1   7. The device as defined in claim 4, containing a time-recursive interpolation

2   filter.

ABSTRACT OF THE DISCLOSURE

Past image point information is also considered as well as local neighboring image point information in the interpolation of a predicted picture for motion-compensated prediction of moving pictures with increased resolution.

5   Motion-compensated image point information is used in the interpolation raster between the scanned values of the reference picture (s'(t-1)) for the predicted picture of increased resolution.
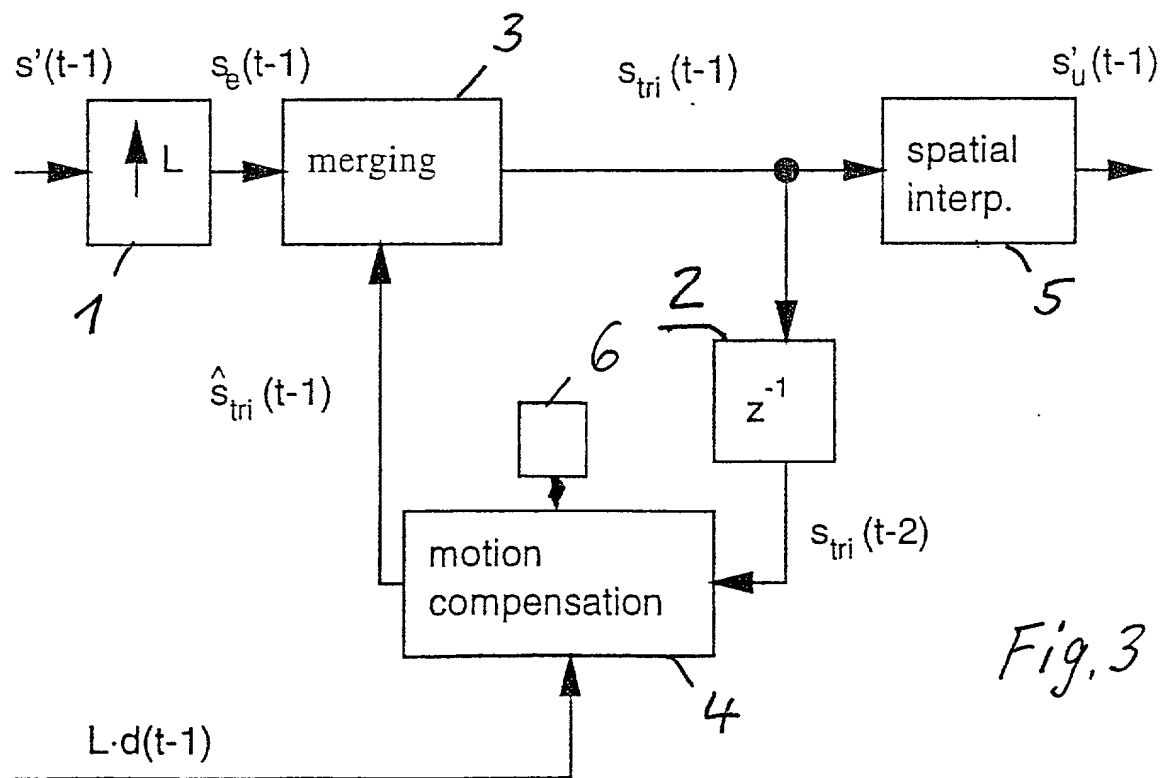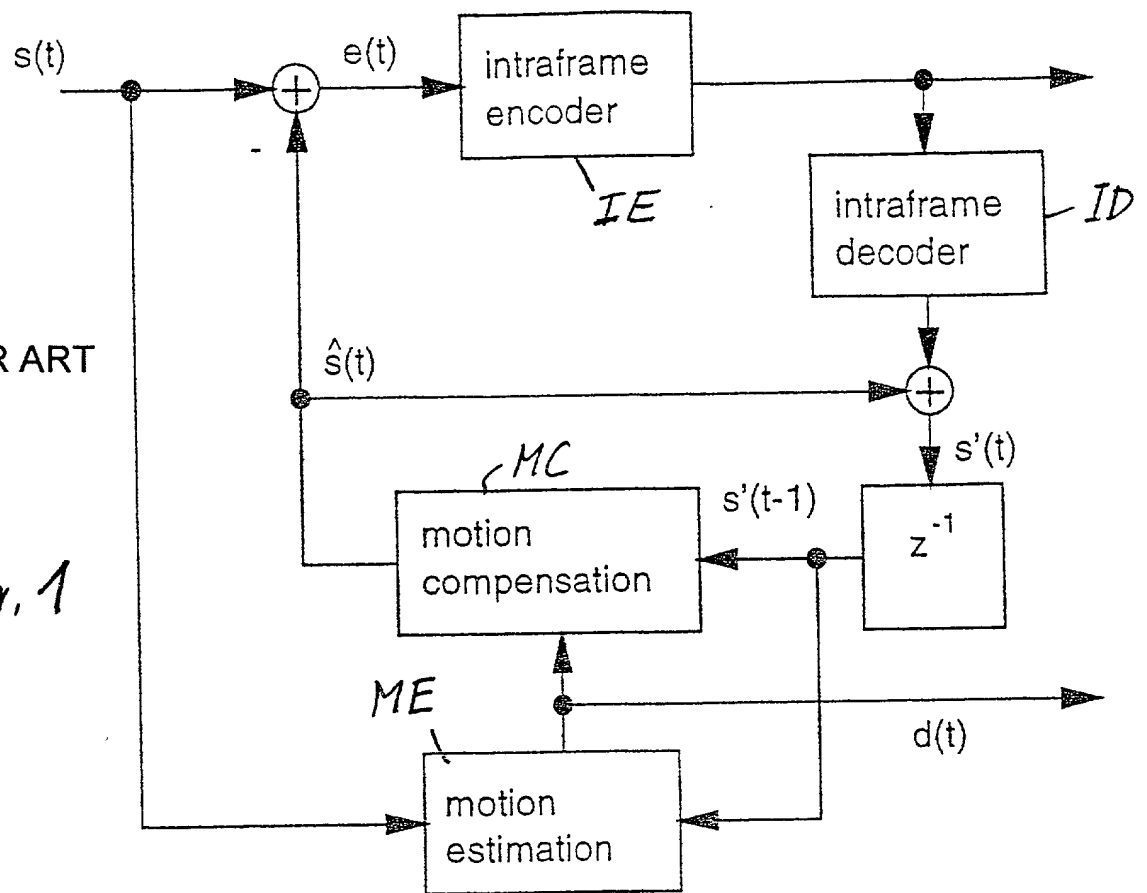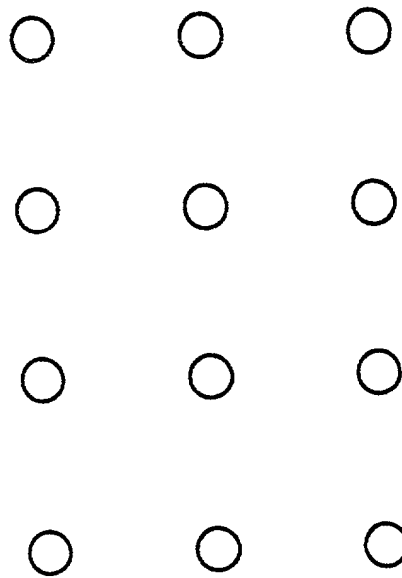
18

PRIOR ART

$Fig. 1$

$Fig. 3$
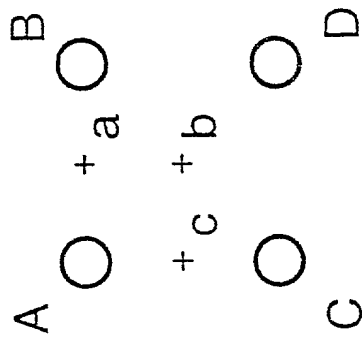
Fig.2

$s_e(t\text{-}1)$

Fig.4

$s'(t\text{-}1)$

A B +a

+c +b

C D

L

○ SCANNED VALUE

m MARKER VALUE

$s_{tri}(t-1)$

$s_e(t-1)$

merging

$\hat{s}_{tri}(t-1)$

SCANNED VALUE FROM $s_e(t-1)$

SCANNED VALUE FROM $\hat{s}_{tri}(t-1)$

m   MARKER VALUE

Fig. 5

Fig. 7

PSNR [dB]

bit per frame [kbit]

Legend:
- ⊖ MPEG4-hp
- ✕ MPEG4-qp
- ⊙ TRI-hp
- ✱ TRI-qp

Fig. 6

PSNR [dB]

bit per frame [kbit]
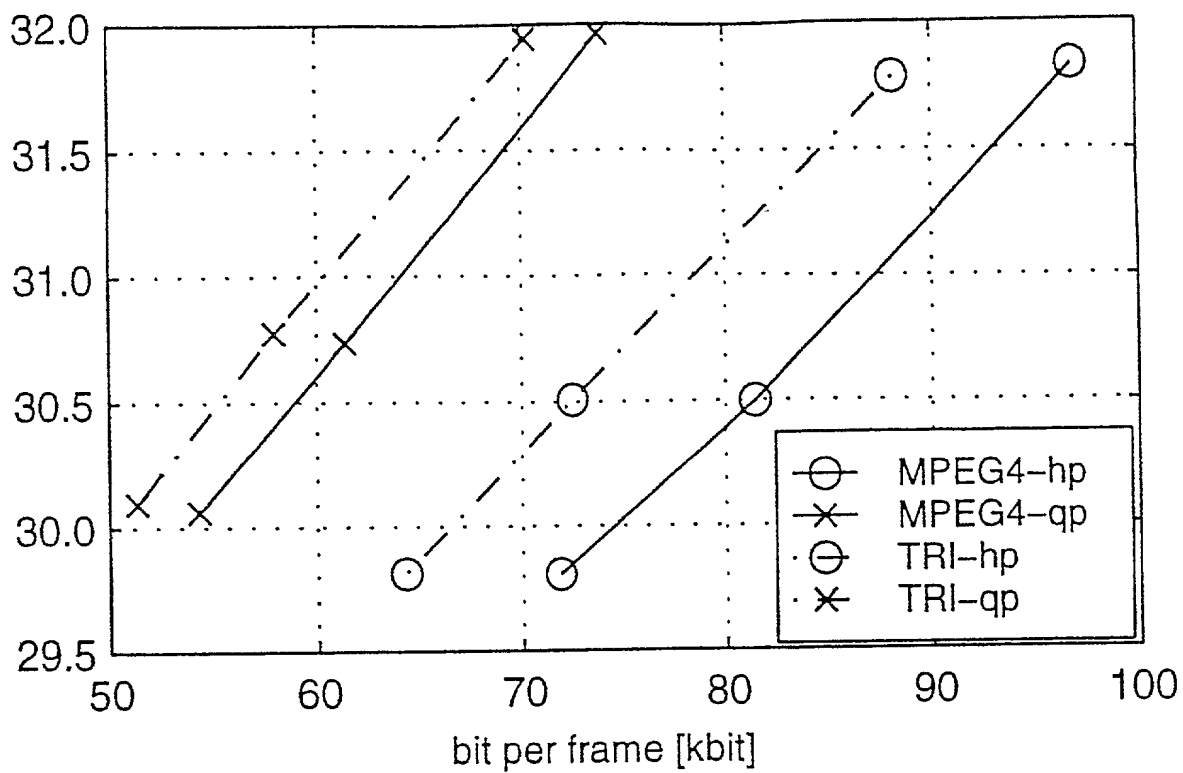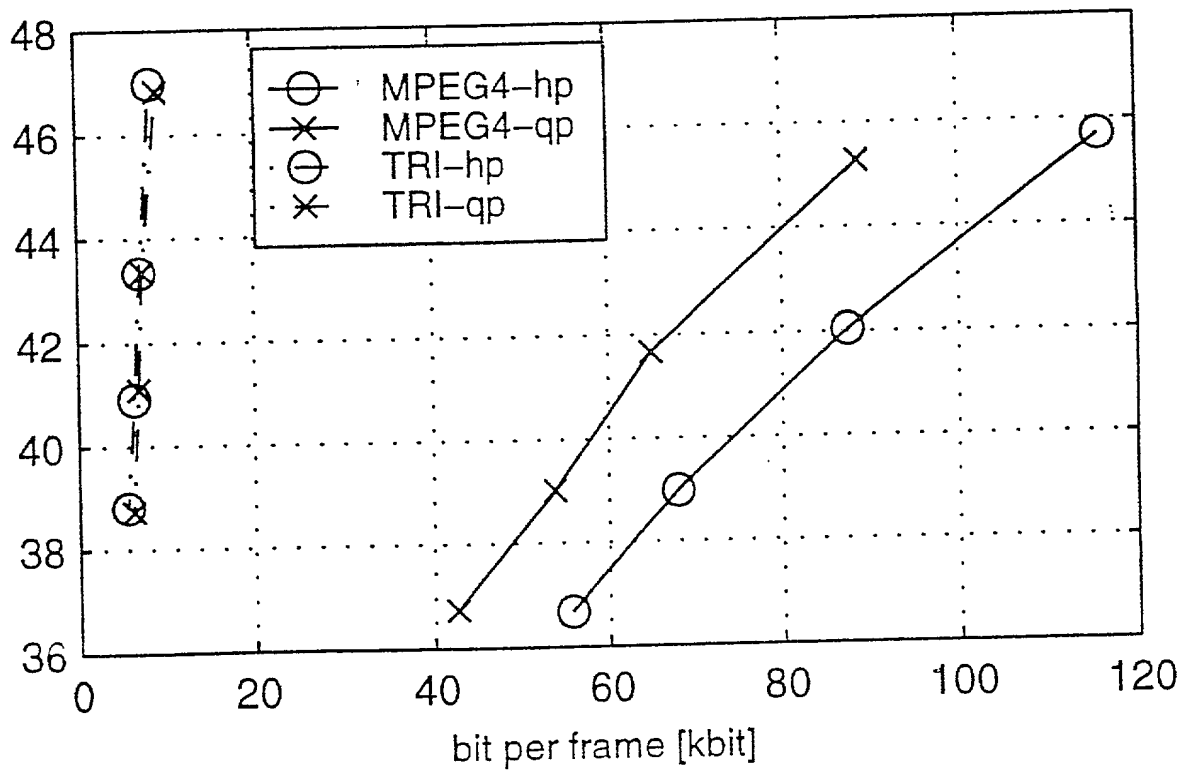
Legend:
- ⊖ MPEG4-hp
- ✕ MPEG4-qp
- ⊙ TRI-hp
- ✱ TRI-qp
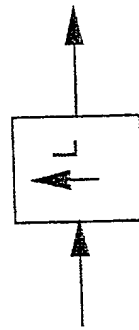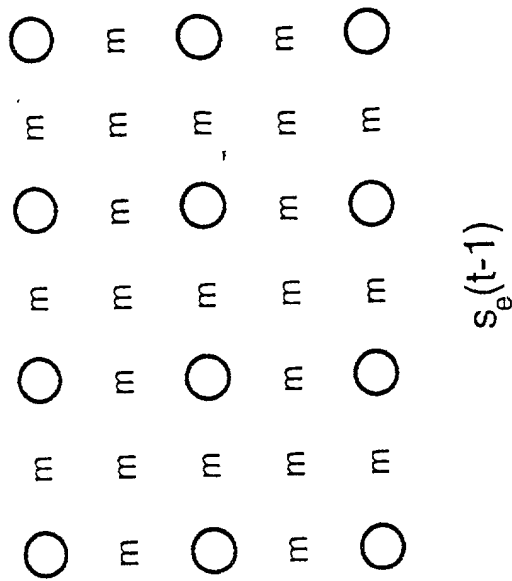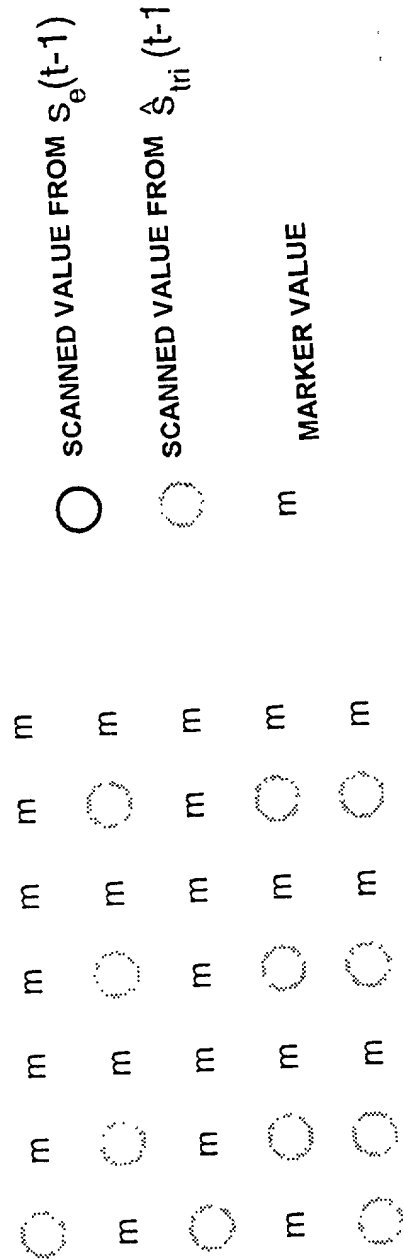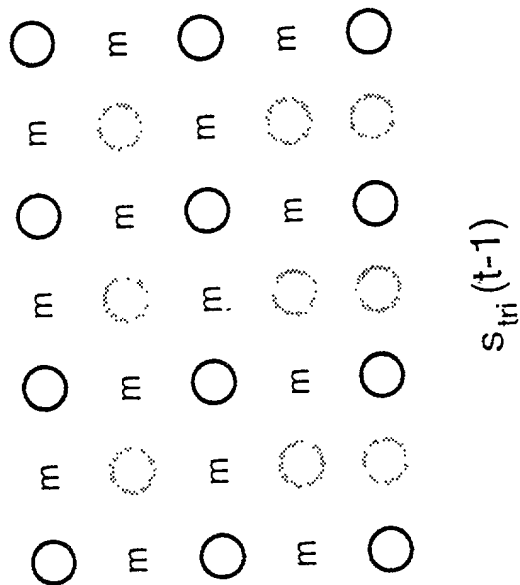
Declaration and Power of Attorney for Patent Application
Erklärung für Patentanmeldungen mit Vollmacht

G e r m a n L a n g u a g e D e c l a r a t i o n

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

As a below named inventor, I hereby declare that:

Hans-Georg MUSMANN
Thomas WEDI

Hans-Georg MUSMANN
Thomas WEDI

dass mein Wohnsitz, meine Postanschrift und meine Staatsangehörigkeit den im nachstehenden nach meinem Namen aufgeführten Angaben entsprechen, dass ich nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent für die Erfindung mit folgendem Titel beantragt wird:

My residence, post office address and citizenship are as stated next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

VERFAHREN ZUR BEWEGUNGSKOMPENSIERENDEN PRÄDIKTION VON BEWEGTBILDERN SOWIE EINRICHTUNG HIERZU

METHOD FOR MOTION-COMPENSATED PREDICTION OF MOVING IMAGES AND DEVICE FOR PERFORMING SAID METHOD

deren Beschreibung hier beigefügt ist, es sei denn (in diesem Falle Zutreffendes bitte ankreuzen), diese Erfindung

the specification of which is attached hereto unless the following box is checked:

☐ wurde angemeldet am_____
    unter der US-Anmeldenummer oder unter der
    Internationalen Anmeldenummer im Rahmen des
    Vertrags über die Zusammenarbeit auf dem Gebiet des
    Patentwesens (PCT) _____und am
    _____abgeändert (falls
    zutreffend).

☐ was filed on_____
    as United States Application Number or PCT
    International Application Number _____
    and was amended on _____(if applicable).

Ich bestätige hiermit, dass ich den Inhalt der oben angegebenen Patentanmeldung, einschliesslich der Ansprüche, die eventuell durch einen oben erwähnten Zusatzantrag abgeändert wurde, durchgesehen und verstanden habe.

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

Ich erkenne meine Pflicht zur Offenbarung jeglicher Informationen an, die zur Prüfung der Patentfähigkeit in Einklang mit Titel 37, § 1.56 von Belang sind.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Code of Federal Regulations, Regulations, § 1.56.

German Language Declaration

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäss Title 35, US-Code, § 119 (a)-(d), bzw. § 365(b) aller unten aufgeführten Auslandsanmeldungen für Patente oder Erfinderurkunden, oder § 365(a)aller PCT internationalen Anmeldungen, welche wenigstens ein Land ausser den Vereinigten Staaten von Amerika benennen, und habe nachstehend durch ankreuzen sämtliche Auslands-anmeldungen für Patente bzw. Erfinderurkunden oder PCT internationale Anmeldungen angegeben, deren Anmeldetag dem der Anmeldung, für welche Priorität beansprucht wird, vorangeht.

I hereby claim foreign priority under Title 35, United States Code, § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Applications
(Frühere ausländische Anmeldungen)

Priority Not Claimed
Priorität nicht beansprucht

199 51 341.4   GERMANY
(Number)   (Country)
(Nummer)   (Land)

OCTOBER 25, 1999   ☐
(Day/Month/Year Filed)
(Tag/Monat/Jahr der Anmeldung)

_____   _____
(Number)   (Country)
(Nummer)   (Land)

_____   ☐
(Day/Month/Year Filed)
(Tag/Monat/Jahr der Anmeldung)

Ich beanspruche hiermit Prioritätsvorteile unter Title 35, US-Code, § 119(e) aller US-Hilfsanmeldungen wie unten aufgezählt.

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s)listed below.

(Application No.)   (Filing Date)
(Akzenzeichen)   (Anmeldetag)

Ich beanspruche hiermit die mir unter Title 35, US-Code, § 120 zustehenden Vorteile aller unten aufgeführten US-Patentanmeldungen bzw. § 365(c) aller PCT internationalen Anmeldungen, welche die Vereinigten Staaten von Amerika benennen, und erkenne, insofern der Gegenstand eines jeden früheren Anspruchs dieser Patentanmeldung nicht in einer US-Patentanmeldung, bzw. PCT internationalen Anmeldung in in einer gemäss dem ersten Absatz von Title 35, US-Code, § 112 vorgeschriebenen Art und Weise offenbart wurde, meine Pflicht zur Offenbarung jeglicher Informationen an, die zur Prüfung der Patentfähigkeit in Einklang mit Title 37, Code of Federal Regulations, § 1.56 von Belang sind und die im Zeitraum zwischen dem Anmeldetag der früheren Patentanmeldung und dem nationalen oder im Rahmen des Vertrags über die Zusammenarbeit auf dem Gebiet des Patentwesen (PCT) gültigen internationalen Anmeldetags bekannt geworden sind.

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

(Application No.)   (Filing Date)
(Akzenzeichen)   (Anmeldentag)

(Status) (patented, pending, abandoned)
(Status) (patentiert, schwebend, aufgegeben)

(Application No.)   (Filing Date)
(Akzenzeichen)   (Anmeldentag)

(Status) (patented, pending, abandoned)
(Status) (patentiert, schwebend, aufgegeben)

Ich erkläre hiermit, dass alle in der vorliegenden Erklärung von mir gemachten Angaben nach bestem Wissen und Gewissen der Wahrheit entsprechen, und ferner dass ich diese eidesstattliche Erklärung in Kenntnis dessen ablege, dass wissentlich und vorsätzlich falsche Angaben oder dergleichen gemäss § 1001, Title 18 des US-Code strafbar sind und mit Geldstrafe und/oder Gefängnis bestraft werden können und dass derartige wissentlich und vorsätzlich falsche Angaben die Rechtswirksamkeit der vorliegenden Patentanmeldung oder eines aufgrund deren erteilten Patentes gefährden können..

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief arebelieved to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

German Language Declaration

VERTRETUNGSVOLMACHT: Als benannter Erfinder beauftrage ich *hiermit* den (die) nachstehend aufgeführten Patentanwalt (älte) und/oder Vertreter mit der Verfolgung der vorliegenden Patentanmeldung sowie mit der Abwicklung aller damit verbundenen Angelegenheiten vor dem US-Patent- und Markenamt: *(Name(n) und Registrationsnummer(n) auflisten)*

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: *(list name and registration number)*

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Unterschrift des Erfinders Datum	Inventor's signature Date
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Staatangehörtigkeit GERMAN	Citizenship GERMAN
Postanschrift Heckenrosenweg 24, 38259 Salzgitter 51, Germany	Post Office Address Heckenrosenweg 24, 38259 Salzgitter 51, Germany
Vor- und Zumane des zweitens Erfinders (falls zutreffend) Thomas WEDI	Full name of second joint inventor, if any Thomas WEDI
Unterschrift des Erfinders Datum	Second inventor's signature Date
Wohnsitz In der Steinriede 12, 30161 Hannover, Germany	Residence In der Steinriede 12, 30161 Hannover, Germany
Staatangehörtigkeit GERMAN	Citizenship GERMAN
Postanschrift In der Steinriede 12, 30161 Hannover, Germany	Post Office Address In der Steinriede 12, 30161 Hannover, Germany